Rainbow upgrade gears up: Dam powerhouse moves toward commissioning

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Jeremy Clotfelter, of PPL Montana, climbs out of the generator cap of the new Rainbow Dam powerhouse. TRIBUNE PHOTO/LARRY BECKNER

Future of the original powerhouse

The original powerhouse, built in 1910, won't be used by PPL Montana after the new powerhouse is commissioned, but its future is uncertain. "That hasn't been determined yet," said David Hoffman, director of external affairs for PPL Montana.

The company held a couple of community meetings in 2008 to gather feedback. "We are still continuing discussions with community leaders," Hoffman said.

Hydropower in Montana

Montana's history of hydroelectric generation dates back to the turn of the 20th century. The facilities listed represent 2,575.4 MW of nameplate capacity; hydroelectric facilities under 10 MW add another 39.9 MW for a total of 2,615.3 MW or 42 percent of the state's nameplate capacity.
Facility, Owner, River, Date built, MW

- Noxon Rapids, Avista, Clark Fork, 1959, 532.4
- Libby, Corps of Engineers, Kootenai, 1975, 525
- Hungry Horse, Bureau of Reclamation S.F., Flathead, 1952, 428
- Yellowtail, Bureau of Reclamation, Big Horn, 1966, 250
- Kerr, PPL Montana, Flathead, 1938, 207.6
- Fort Peck, Corps of Engineers, Missouri, 1943, 185.3
- Thompson Falls, PPL Montana, Clark Fork, 1915, 87.1
- Rainbow, PPL Montana, Missouri, 1910, 61.6
- Cochrane, PPL Montana, Missouri, 1958, 60.4
- Canyon Ferry, Bureau of Reclamation, Missouri, 1953, 49.8
- Ryan, PPL Montana, Missouri, 1915, 48
- Morony, PPL Montana, Missouri, 1930, 45
- Holter, PPL Montana, Missouri, 1918, 38.4
- Hauser, PPL Montana, Missouri, 1911, 17
- Black Eagle, PPL Montana, Missouri, 1927, 16.8

- Turnbull, Turnbull Hydro LLC, Greenfields Irrigation Canal, 2011, 13
- Mystic, PPL Montana, West Rosebud Creek, 1925, 10

Source: Montana Department of Commerce

On the outside, the new powerhouse for PPL Montana's Rainbow Dam, set into the north shore of the Missouri River about six miles northeast of Great Falls, looks upstaged by the 103-year-old, brick multistory facility it will replace soon.

Its roughly 50-foot-high exterior is designed to blend in with the sandstone, limestone and native grasses that make up the river's bank. By contrast, the original powerhouse, which will be in use until its new neighbor is fully commissioned sometime during the next few months, is a stately structure some say is worthy of preservation for its historical value.

Outside appearances are deceiving.

The new powerhouse's single turbine will generate 60 megawatts of electricity, 70 percent more than the eight turbines in the original powerhouse.

Inside, it's cavernous. The top of the turbine sits down inside an enormous circular cutout in the floor and a new crane is attached to the ceiling roughly four stories high.

"It's basically a huge work bay," said Jeremy Clotfelter, PPL Montana's manager of hydroelectric operations and maintenance.

There's enough room to lift the turbine and generator up and out with the crane if needed for maintenance or repairs.

The control center is located off the main "work bay," in a room along back of the building. Mazes of stairs allow personnel to access the turbine's lower levels, which drop down another 70 feet from the main floor.

With a price tag of $230 million, the Rainbow Dam powerhouse is the largest single private-sector commercial project in recent history, said Brett Doney, president of the Great Falls Development Authority.

"Any time you have a single project of $20 million or more, that's a big project by Montana standards," said Cary Hegreberg, executive director of the Montana Contractors Association. "This was a huge project, and it came at a great time for the state's construction industry."

The recession forced many projects to be shelved or delayed when ground broke for the Rainbow Dam powerhouse in October 2009.

"It was great for local contractors, local suppliers," Doney said. "We had workers moving into the area at a time when other places had hundreds of construction trades people looking for work."

The pending capacity increase of Rainbow Dam was one of the precursors to a $55 million upgrade of PPL Montana generator lead lines in Cascade County.

"In the future, as the energy market improves, our hope is that there will be additional upgrades," Doney said.

Originally, the project was slated to be completed in the spring of 2012.

"With something of this scope, delays aren't unusual," said David Hoffman, PPL Montana's director of external affairs.

Although weather was factored in during the three years of project planning, 2010 was an unusually harsh winter with heavy snowfall. That was followed by the abnormally high water during the spring of 2011.

PPL Montana does not have an estimate of man-hours accumulated during the construction of the powerhouse, but at times there were 225 workers on site.

More than a half-million tons of earth and rock was moved during the project, with more than 60,000 cubic yard of concrete poured and approximately 7 million pounds of rebar installed.

The original powerhouse receives water via underground flow lines. The new powerhouse will get water from the dam's intake via a new half mile canal instead.

The canal system means there is no surge pond needed for the new powerhouse. The surge pond in use now will be deconstructed and reclaimed after the original powerhouse is decommissioned.

The configuration of the new plan will increase efficiency and output, and one result will be an increase in output at Cochrane Dam a couple of miles downstream by a couple of megawatts.

The turbine inside the new powerhouse is a kaplan turbine with four blades that rotate and turn for maximum efficiency. It rotates at 144 rotations per minute.

"It also has a wider flow passage and with fewer rotating surfaces, it will be easier for fish to pass through unharmed," Hoffman said. "The new intake structure will also improve fish passage."

The dam uses a bladder, made by Bridgestone, which can be inflated or deflated as needed to control water flow rather than the more typical gate and board control method.

The beehive of activity around the site during the height of construction is over. Staging sites where heavy equipment and supplier once stacked up are reclaimed and seeded, ready for warm weather to coax the hillsides back to their original state.

PPL Montana will have 35 permanent employee at the site, who also manage the operations of the company's four other dams in this area: Black Eagle, Cochrane, Ryan and Morony.

"Before the project started, standing on a hill, looking at a bank with nothing but rock and sage brush, it was hard to visualize," Hoffman said. "Now that it is almost finished, looking at it, it is quite humbling."